

Perfect Square Trinomial Factoring | MPM2D

Motivation: Expand the following binomial products. Use FOIL if you need to, it would be even better if you could recall the special product we learned several days ago.

$$\begin{aligned} \text{a) } (x-4)^2 & \\ &= (x-4)(x-4) \\ &= x^2 - 4x - 4x + 16 \\ &= x^2 - 8x + 16 \end{aligned}$$

$$\begin{aligned} \text{b) } (x+6)^2 & \\ &= (x+6)(x+6) \\ &= x^2 + 6x + 6x + 36 \\ &= x^2 + 12x + 36 \end{aligned}$$

$$\begin{aligned} \text{c) } (2x+5)^2 & \\ &= (2x+5)(2x+5) \\ &= 4x^2 + 10x + 10x + 25 \\ &= 4x^2 + 20x + 25 \end{aligned}$$

$$\begin{aligned} \text{d) } (3x-2y)^2 & \\ &= 9x^2 - 12xy + 4y^2 \end{aligned}$$

$$\begin{aligned} \text{e) } (4a+5b)^2 & \\ &= 16a^2 + 40ab + 25b^2 \end{aligned}$$

Recall that squaring a binomial produced a **perfect square trinomial**:

$$(a+b)^2 = a^2 + 2ab + b^2 \quad \text{OR} \quad (a-b)^2 = a^2 - 2ab + b^2$$

KEY IDEA:

If you have a perfect square trinomial $a^2 \pm 2ab + b^2$, you can factor it directly as $(a \pm b)^2$.

Example: Verify that each of the following are **perfect square trinomial** expressions. Then, factor them.

$$\begin{aligned} \text{a) } x^2 + 18x + 81 & \quad \sqrt{x^2} = x \\ & \quad \sqrt{81} = 9 \\ & \quad 2(x)(9) = 18x \\ &= (x+9)^2 \end{aligned}$$

✓

$$\begin{aligned} \text{b) } 25x^2 + 10x + 1 & \\ &= (5x+1)^2 \end{aligned}$$

$$\begin{aligned} \sqrt{25x^2} &= 5x \\ \sqrt{1} &= 1 \\ 2(5x)(1) &= 10x \end{aligned}$$

✓

$$\begin{aligned} \text{c) } 36x^2 - 84x + 49 & \\ &= (6x-7)^2 \\ & \quad \sqrt{36x^2} = 6x \\ & \quad \sqrt{49} = 7 \\ & \quad 2(6x)(7) = 84x \end{aligned}$$

✓

$$\begin{aligned} \text{d) } 4x^2y^2 - 44xy + 121 & \\ &= (2xy-11)^2 \end{aligned}$$

$$\begin{aligned} \sqrt{4x^2y^2} &= 2xy \\ \sqrt{121} &= 11 \\ 2(2xy)(11) &= 44xy \end{aligned}$$

✓

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Again, don't think of this as one more method of factoring to memorize, think of it as a shortcut to help make your factoring even easier.

Remember that you should always check to common factor first.

Example: Common factor the following expressions, and then apply perfect square trinomial factoring if you can! If you cannot, use decomposition.

$$\begin{aligned} \text{a) } & 5x^2 + 20x + 20 \\ & = 5(x^2 + 4x + 4) \\ & = 5(x+2)^2 \end{aligned}$$

$$\begin{aligned} \sqrt{x^2} &= x \\ \sqrt{4} &= 2 \\ 2(x)(2) &= 4x \end{aligned}$$



$$\text{b) } 12x^2 - 72x + 27 = 3(4x^2 - 24x + 9)$$

DONE

$$\begin{aligned} \sqrt{4x^2} &= 2x \\ \sqrt{9} &= 3 \\ 2(2x)(3) &= 12x \end{aligned}$$



$$\begin{aligned} \textcircled{\times} & 36 \\ \textcircled{+} & -24 \end{aligned}$$

No #s

$$\text{c) } 8x^2 + 26x + 18 = 2(4x^2 + 13x + 9)$$

$$\begin{aligned} \sqrt{4x^2} &= 2x \\ \sqrt{9} &= 3 \\ 2(2x)(3) &= 12x \end{aligned}$$



$$\begin{aligned} \textcircled{\times} & 36 \\ \textcircled{+} & 13 \end{aligned}$$

$$= 2(4x^2 + 4x + 9x + 9)$$

$$= 2(4x(x+1) + 9(x+1))$$

$$= 2(x+1)(4x+9)$$

Now it is time to practice:

- Head to page 253 in your text, copy down the last key concept.
- Try #3, 4, 5bc, 6abc, 8abde